CHAPTER III

REVIEW RELATING TO STATUTORY CORPORATION

3. RENOVATION AND MODERNISATION OF PALLIVASAL, SENGULAM AND PANNIAR HYDRO POWER PROJECTS BY KERALA STATE ELECTRICITY BOARD

Highlights

The Board identified SNC Lavalin Inc, Canada (SNC) as the supplier-cum-consultant for the renovation and modernisation of the Pallivasal, Sengulam and Panniar hydro electric power projects at an aggregate estimated (September 1995) cost of Rs.239.81 crore. Audit noticed that:

- **there were deviations from prescribed procedures in selection of these projects for renovation and in the award of contract to SNC Lavalin;**
- **absence of due professional care in negotiating the foreign loan proved to be detrimental to the financial interests of the Board;**
- **the expenditure of Rs.374.50 crore incurred for renovation did not yield commensurate gains due to various technical defects in the equipment renovated; and**
- **the very objective of improvement in efficiency of machines could not be achieved as there was no improvement in the generation of power.**

(Paragraphs 3.1, 3.11, 3.13 and 3.36)

The Board's failure to exclude the overlapping technical consultancy fee from the final fixed price contract resulted in avoidable payment of Rs.20.31 crore.

(Paragraph 3.12)

There were instances involving avoidable payment of Rs.12.89 crore towards commitment fee and exposure fee.

(Paragraphs 3.14 and 3.15)

The Government did not receive Rs.89.32 crore out of the grant of Rs.98.30 crore agreed to be provided for Malabar Cancer Hospital as part of the renovation contract.

(Paragraph 3.18)

Introduction

3.1. The Hydro Electric Power Stations of the Board at Pallivasal (37.5 Mega Watt), Sengulam (48 Mega Watt) and Panniar (30 Mega Watt) were installed during the period 1940-64. On the ground that the generators in the Power Stations had outlived their life, the Board signed (August 1995) an Memorandum of Understanding (MoU) with SNC Lavalin, Canada for providing services and other resources to the Board for implementation of rehabilitation projects. This MoU was converted (February 1996) into consultancy agreements for renovation of Pallivasal, Sengulam and Panniar Power Stations and subsequently (February 1997) the supply of equipment and engineering services was also entrusted to SNC. The finally accepted (July 1998) cost of Rs.239.81 crore included foreign exchange component (Rs.149.15 crore), 85 *per cent* of which (Rs.126.78 crore) was to be funded by Export Development Corporation, Canada and the balance from the Board's own resources. On completion of the renovation (October 2001) all the Power Stations were expected to function at maximum efficiency level thereby avoiding losses due to major breakdowns, pre-arranged/emergency shutdowns of machines.

Scope of audit

3.2. The performance audit review conducted during the period January to May 2005 covers the conceptualisation, financing and implementation of the renovation work of Pallivasal, Sengulam and Panniar hydro electric Power Stations and their performance after completion of renovation.

Audit objectives

3.3. Performance audit of the project was conducted with a view to assess whether:

- the renovation was actually necessary;
- the financing by the external agency was beneficial to the Board;
- the procurement of machinery, equipment and services was carried out in a cost effective manner; and
- the performance of Power Stations after renovation was efficient.

Audit criteria

3.4. The basic audit criteria used for assessment was to evaluate whether:

- The project for renovation was undertaken after taking into account other new capacity addition programmes on the anvil.
- the opinion of the expert bodies on the necessity of renovation was obtained.
- proper and accepted procedures for identification of consultant and suppliers of plant and equipment were adopted and cost effective procurement was made.

- funding for the project was negotiated properly and cost of financing was optimum.
- cost of the project was comparable with that agreed/incurred for similar renovation/modernisation projects undertaken by the Board.
- the level of performance of renovated plant was more efficient when compared to pre-renovation performance.
- the renovated plant and machinery were of specified quality and efficiency.

Audit methodology

3.5. The methodology adopted for review of the various activities connected with planning of renovation projects, financing, implementation and performance after re-commissioning was:

- Review of minutes of the discussions held by the Ministerial delegation at Canada as well as that of the Board of Members.
- Scrutiny of consultancy agreements, Reports by the Central Electricity Authority, detailed project reports, agreements with suppliers and financing agencies, Cabinet notes and decision on foreign loan, generation data and technical information compiled by the Board.

Audit findings

3.6. Audit findings as a result of test check were reported to the Company/Government in June 2005 and discussed in the meeting of the Audit Review Committee on Public Sector Enterprises (ARCPSE) held on 27 July 2005, which was attended by the Principal Secretary to the Government of Kerala, Power Department and the Chairman of the Board. The views expressed by the members have been taken into consideration while finalising the review.

Audit findings are discussed in the succeeding paragraphs.

Project description

3.7. Pallivasal, Sengulam and Panniar Hydro Power Stations are located in the Idukki District of the State of Kerala. Water from Kundala and Mattupetty reservoirs is utilised for power generation at Pallivasal. The Sengulam Power Station is dependent on Pallivasal since the tail water from Pallivasal is being pumped to the Sengulam balancing reservoir and used for generation of electricity. Panniar Power Station served by the Anayirankal and Ponmudi reservoirs, is located adjacent to the Sengulam power plant.

A flow chart showing the sources of water and locations of the three generating stations is given in **Annexure 17**.

Project formulation

3.8. The Board proposed (1990) to the Central Electricity Authority (CEA) the Pallivasal Rehabilitation Scheme for extension of the then existing facility

with an under ground Power Station. CEA recommended (1992) that immediate replacement of the generating units of Pallivasal Power Station was not necessary, since the plant was in fairly good condition and suggested a new scheme of 60 MW as an augmentation of the existing scheme.

Panniar Augmentation scheme to improve the water inflow and increase the power generation by 29.43 MU, was also underway (1995). Similarly, Sengulam Augmentation Scheme for additional power generation of 85 MU was also under consideration of the Board. All the above augmentation schemes necessitated uprating of capacity of generators rather than renovation.

3.9. While the above schemes were under consideration/implementation, the Board, ignoring the recommendations of the CEA on the good conditions of the Pallivasal Power Station, entered into (August 1995) a Memorandum of Understanding (MOU) with SNC Lavalin Inc, Canada (SNC) for establishing a joint venture association for carrying out rehabilitation of existing facilities, identifying the three Hydro Electric Projects at Pallivasal, Sengulam and Panniar for the first batch of renovation. As per the MOU, finance for the renovation was to be arranged by SNC from Export Development Corporation (EDC), Canada and Canadian International Development Agency (CIDA).

3.10. Feasibility of renovation of the three projects was studied (September 1995) by a retired Chief Engineer of the Board who was later identified by the Board itself as a consultant to SNC. Based on the consultant's report and further discussions, contracts were signed (February 1996) with SNC for providing technical services for management, engineering, procurement and construction supervision to ensure completion of the projects within three years. Based on subsequent discussions held (October 1996) by a delegation headed by the Minister for Electricity, Government of Kerala, the consultancy agreements were converted (February 1997) into fixed price contracts for supply of goods and services for the renovation at a cost of 67.94 million Canadian Dollars (CAD) (Rs.169.03 crore[*]). Arrangement of 85 *per cent* foreign financing by EDC was also included in the contracts. With the reduction in scope of supply of Panniar renovation work (7.52 million CAD) and consultancy charges (0.47 million CAD), the foreign exchange component finally agreed to be paid to SNC for supplies and services (July 1998) was 59.95 million CAD(Rs.149.15 crore), including total consultancy charges of 7.19 million CAD(Rs.17.89 crore)

3.11. The following were noticed in the project formulation and sanction:

- The renovation of the Pallivasal Power Station was taken up disregarding the opinion of CEA not to replace the generators and ignoring the improvement in performance factor of Pallivasal Power Station from 4.867 in 1981 to 5.466 in 1996-97 (The performance factor actually recorded during the post-renovation period of 2003-04 was only 4.588).
- Sengulam and Panniar Power Stations required enhancement in capacity. Instead the Board considered their renovation. The three schemes (Pallivasal, Sengulam and Panniar) proposed by the Board were sanctioned by the Government as a composite scheme.

[*] Conversion rate adopted as one Canadian Dollar equal to Rs.24.88

- Prior to signing (August 1995) of the MoU the Board did not conduct a feasibility study justifying the necessity for undertaking the renovation. The proposal for renovation of Pallivasal, Sengulam and Panniar Power Stations was not prepared and submitted to the Central Electricity Authority for concurrence as required under Section 29(1) of the Electricity (Supply) Act, 1948.

Government replied (August 2005) that the Ministry of Power, Government of India had adjudged the fair life of hydro electric plant and machinery to be 35 years and the Board decided to renovate and modernise the Pallivasal, Panniar and Sengulam generating stations considering various factors such as life of old units, generation loss due to increased shut downs, etc. It was also stated that only those power schemes with capital expenditure of over Rs.100 crore were required to be submitted to CEA for concurrence and since the estimated cost of each of the projects, as per the detailed project reports prepared for the three projects, was below Rs.100 crore, concurrence of CEA was not obtained.

The reply is not tenable since the Board did not provide evidence of any study done before entering into the MoU with SNC and also ignored the opinion of CEA on the condition of the plant at Pallivasal. Since the three schemes were proposed by the Board and sanctioned by the Government as a composite project involving capital expenditure exceeding Rs.100 crore, splitting the project to avoid concurrence by the CEA appeared to be a post facto rationalisation.

Global tenders were not invited and reasonableness of price was studied eight months after award of the contract.

- The feasibility study was conducted (September 1995) by the Board after signing (August 1995) the MOU, by engaging a retired Chief Engineer who became a consultant to the principal contractor (SNC) itself. Global tenders were also not invited either before entering into the contract for consultancy or final agreement with SNC for supply, erection and commissioning of the projects.

Government stated (August 2005) that there was no record to indicate that the retired Chief Engineer was a consultant to SNC in 1995 when he prepared the feasibility report. The reply is evasive as there is 'a conflict of interest' in the retired Chief Engineer becoming the consultant of SNC. The Board could also not provide any confirmation regarding independence of the consultant at the time of rendering the feasibility study.

- No action was taken by the Board to ensure the reasonableness of the prices quoted by SNC in October 1997 before signing of the contracts. Instead, eight months after signing of the contracts, the Board sought post facto justification of the contract price through the entrustment of a study to National Hydro Electric Power Corporation Limited (NHPC). It was seen from NHPC's report that the technical specifications of the equipment required for price comparison purposes were not made available to them. It was also seen that NHPC had not certified the reasonableness of the prices but had only stated that keeping in view of the soft loan with grant element, the purchase for Canadian equipment and accessories could be considered favourably. As the grant was not received (as discussed in paragraph 3.18 infra) there was hardly any justification as per NHPC's report.

- The Kerala State Electricity Board (Meetings) Regulations, 1957 prescribed that the Board shall meet at least once in a month and any urgent matter transacted in between meetings should be ratified in the immediate succeeding meeting. The full Board was, however, not aware of the necessity for renovation, the signing of MOU (August 1995), or the contract (February 1996) for technical services with SNC, till January 1997 even though 28 Board meetings were held during the period from January 1995 to December 1996. Final contracts (February 1997) for design, supply and installation of equipment with SNC was formally approved by the Board only in January 1998.

There was deviation from prescribed procedures in the award of contracts to SNC Lavalin.

The Ministerial delegation which conducted (October 1996) deliberations on the contract with SNC and funding arrangements with EDC and CIDA at Canada did not even consider the fact that SNC was only a consultant intermediary and not the original equipment manufacturer (the supply of goods was actually made under the contracts by Alstom, Canada). The contracts were finally signed (February 1997) with undue haste without ascertaining the reasonableness of prices.

Project consultancy

3.12. The contract signed (February 1996) by the Board with SNC for technical services for renovation of Pallivasal, Sengulam and Panniar Power Stations provided for payment of a total service charge amounting to 7.19 million CAD. The services to be provided were:

- Preliminary and Detailed engineering
- Preparation of drawings, specifications, bills of quantities and tender documents.
- Calling for and evaluation of tenders and award of contracts.
- Producing civil drawings
- Review and approval of contractor's design, drawings and other submissions
- Construction supervision and inspection
- Commissioning
- Technology transfer and technical training

Subsequently, the contracts for detailed technical specification and design of equipment, manufacture, shop assembly and testing, painting and packing, delivery and supervision of installation was awarded (February 1997/ July 1998) to the consultants themselves at a total fixed price of 59.95 million CAD (Rs.149.15 crore).

With the award of the above contracts the consultants (SNC) became contractors for supply of equipment and services as well as installation, and the technical services contemplated in the consultancy services viz., preliminary and detailed engineering, design, calling for and evaluation of tender, supervision of installation, etc., were rendered superfluous. The Board, however, awarded the detailed design, supply, installation and

supervision contract as an addendum to the earlier consultancy contracts without excluding 7.19 million CAD (Rs 17.89 crore) provided for therein. The technology transfer and training of engineering personnel of the Board was also not undertaken by SNC, as discussed in paragraph *3.22 and 3.23 infra*.

Failure to exclude fee for technical consultancy from fixed price contracts resulted in avoidable payment of Rs.20.31 crore.

Thus, the failure of the Board to exclude the overlapping fee for technical services from the final fixed price contracts for renovation of the projects resulted in avoidable payment of Rs.20.31 crore∗.

Government stated (August 2005) that SNC played two different roles as consultant and supplier and hence there was no duplication or overlapping of payments to SNC. The reply is not acceptable since on the firming up of the consultancy contracts into supply contracts SNC no longer performed the role of a technical and financial intermediary. Due to this, there was no rationale for making payments for intermediary services.

Project Financing

3.13. As per the MOU (August 1995) the funds required for financing of the project were to be arranged by SNC from EDC and CIDA. In order to firm up the finance, a Ministerial delegation visited (October 1996) Canada and negotiated with EDC and CIDA a loan of 54.4 million CAD representing 85 *per cent* of the contract value of 60.4 million CAD and 3 million CAD towards exposure fee. The loan from EDC carried interest rate of 6.8 *per cent* per annum in addition to one time payment of above exposure fee and administration fee of 0.5 *per cent.* The loan was to be disbursed in instalments as advance to SNC, as per specific schedules prescribed in the commercial contracts and carried a commitment fee of 0.375 *per cent* per annum on the unavailed portion of the loan. After further negotiation, agreement for the final loan amount of 53.8 million CAD was executed (July 1998) and the loan was repayable in 17 semi-annual instalments from October 2001.

The absence of due professional care in negotiating the foreign loan proved to be detrimental to the financial interests of the Board as discussed in the succeeding paragraphs.

Payment of exposure fee

3.14. During negotiation (October 1996) of the foreign loan, EDC agreed to accept State Government guarantee to the extent of 57 *per cent* for the foreign loan component with an exposure fee[#] of 5.84 *per cent*. Subsequently, the Central Government denied (April 1998) permission for the State Government Guarantee for foreign loans and the Board provided (July 1998) Deferred Payment Guarantee (DPG) by bankers, involving a total liability of Rs.30 crore towards commission and upfront fee. Notwithstanding the financial security provided by way of DPG, the Board finally incorporated a provision for payment of 4.76 *per cent* towards exposure fee and made

∗ Actual payment up to March 2005

[#] As a normal course of business, EDC charges exposure fee as a part of its compensation for risk undertaken when providing medium-long term export credit.

Failure to negotiate and exclude the exposure fee from loan agreement resulted in avoidable payment of Rs.9.48 crore and future liability of Rs.2.21 crore.

payment of Rs.9.48 crore (including interest) up to 31 March 2005 and a future liability of Rs.2.21 crore. Since the exposure fee was intended to secure against the risk of default in the payment of instalments of loan and interest, there was no need for including the exposure fee in the loan agreement when the security cover was provided in the form of DPG by bankers.

Thus, the failure to negotiate and exclude exposure fee from the loan agreement resulted in avoidable/committed payment of Rs.11.69 crore (including future liability of Rs.2.21 crore).

Government stated (August 2005) that the exposure fee was never intended to secure against default in repayment of instalments of loan and interest but was demanded by an international agency to protect against what the agency perceived as country's risk. The reply is not acceptable in view of the fact that as per internationally accepted Policy and Procedure Manual the exposure fee is the 'anticipated cost of the lending Government to cover the potential default by the borrower of principal and interest on original contract terms'.

Payment of commitment charges

3.15. As per the loan agreement (July 1998) the Board had to pay towards commitment fee to EDC on each interest payment date a sum equal to 0.375 *per cent* per annum on the portion of unavailed loan with effect from the date of agreement.

Avoidable payment towards commitment fee when there was no committed unavailed advance amounted to Rs.1.20 crore.

It was, however, noticed during audit that as per Article III of the agreement it was the responsibility of the exporter (SNC) to provide a schedule of dates of anticipated advances, and payments were to be made by EDC direct to SNC in US Dollars against the prescribed milestone dates based on the commercial contract. At the time of entering into the loan agreement, the Board was aware of the fact that the milestone payments were to be made in five instalments commencing from August 1998. The actual payment of 31.5 million CAD (Rs 92.92 crore[*]) was also made as scheduled. Hence, the undrawn advances were committed by EDC for specific dates during the period up to November 2000 and payments could not have been made on any other date. The avoidable payment made towards commitment fee when there was no committed unavailed advance during the period up to November 2000 worked out to Rs.1.20 crore.

Deferred Payment Guarantee cover

3.16. Section 4.01 of the loan agreement provided for indemnification of repayment to EDC of the principal and interest on the indebtedness of the Board. The indebtedness as defined under Article I thereunder included principal, interest, administration fee, commitment fee, expenses and any additional amounts payable from time to time. In conformity with the agreement, the Board provided (July 1998) deferred payment guarantee (DPG) cover from bankers for a total amount of Rs.200 crore. The Board had to pay

[*] Conversion rate:One Canadian Dollar equal to Rs.29.50

a commission of 1.6 *per cent* per annum along with one time payment of 0.8 *per cent* towards fronting charges[#] and 1.05 *per cent* upfront charges.

Creation of excessive DPG cover resulted in avoidable payment of commission of Rs.2.77 crore and future liability of Rs.93 lakh.

3.17. Audit noticed that the maximum indebtedness of the Board during the tenure of the loan was below Rs.180 crore∗. The Board, however, over-estimated the indebtedness as Rs.200 crore and furnished DPG from bankers for an equivalent amount. The decision of the Board to create excessive (Rs.20 crore) DPG cover resulted in avoidable extra expenditure of Rs.2.77 crore towards commission and other expenses as of December 2004 and a future liability of Rs.93 lakh for the period up to October 2009.

The Government stated (August 2005) that the actual liability amount exceeded Rs.200 crore even at present and hence the argument that total liability was to be limited at Rs.180 crore was not correct. The reply is not tenable in view of the fact that during the period from July 1998 to April 2005 the actual liability was only in the range of Rs.22.57 crore to Rs.168.80 crore and by fixing the DPG cover at a higher level the Board had to pay commission to the Bankers without actually having the liability to the extent of the DPG cover.

Grant for Cancer Hospital

The Government did not receive Rs.89.32 crore out of the grant of Rs.98.30 crore agreed to be provided for Malabar Cancer Hospital.

3.18. During negotiation (October 1996) of the contract by the Ministerial delegation, SNC agreed to mobilize funds for construction of a Cancer Hospital in Malabar area of the State. This was followed (April 1998) with an MOU between SNC and Government to finance implementation of the hospital project. As per the project report prepared by SNC, the Malabar Cancer Centre (MCC) was to cost Rs.103.30 crore; Rs.98.30 crore was to be mobilised by SNC and the balance (Rs. 5 crore) was to be State Government contribution. The actual contribution made (up to February 2001) by SNC towards this project was only Rs.8.98 crore by way of direct payment to Technicaliya Consultants Private Limited, a Chennai based firm for works in connection with the hospital. There were no records available to show that further funding was made towards the project (April 2005). The MOU has also not been renewed after March 2002 for reasons not on record.

3.19. It was noticed during audit that as per the Board Minutes dated 13 January 1998 the contribution to be made by SNC for setting up MCC was an important factor taken into consideration while finalising the contracts for renovation of Pallivasal, Sengulam and Panniar power projects even though the Board was not directly concerned with funding proposals in the social sector. The funds for setting up MCC were also agreed (December 1997) to be provided by SNC on satisfactory conclusion of agreement by the Board for renovation of projects. NHPC recommendations (October 1997) on the reasonableness of prices under the contracts were also based on this grant element.

[#] Fee charged by the bank to insure the risk

∗ Cumulative principal amount released (Rs.150.19 crore) as of October 2001 plus interest thereon (Rs.17.22 crore) and Commitment fee (Rs.1.39 crore) = Rs.168.80 crore. Taken as Rs.180 crore to accommodate further loan drawn, Rs.7.56 crore.

The Government stated (August 2005) that there was no enabling provision in the contracts for R&M of Pallivasal, Sengulam and Panniar projects to appropriate dues to SNC against financial assistance promised to be arranged by them for Malabar Cancer Centre Society. The fact, however, remained that the Board of Members of KSEB considered this assistance at the time of ratification of the contract and SNC had also stated (December 1997) that the Malabar Cancer Centre project was directly connected with the project for renovation and the grant element could be availed on satisfactory conclusion of the loan agreement. The Board, however, did not follow up the matter.

Implementation of the projects

3.20. As per the contract, the supply of Canadian goods was to be completed within 27 months from the effective date (September 1998) of the contract i.e. by November 2000 and the project was to be commissioned by September 2001. It was noticed in audit that the implementation of the project was not planned properly. The work was originally proposed to be carried out by simultaneous shut down of all the three Power Stations. Later, for utlilisation of water inflow during shut down period, the work was carried out in two phases by keeping half the units of each Power Station in service. Due to technical problems, delays in completion of associated works and delay on the part of SNC to attend to pre-commissioning works, etc., the commissioning of the projects were delayed. The work was finally completed and the projects commissioned during the period October 2001 to February 2003 at a total cost of Rs.259.40 crore (excluding financing charges of Rs.63.83 crore). The details of projects, date of commissioning and generating capacity were as follows:

Name of project	Targeted date of recommissioning	Date of re-commissioning	Generating capacity (MW)
Pallivasal: Units I-III	September 2001	October 2001	15.00
Units IV-VI	September 2001	August 2002	22.50
Sengulam: 4 units	September 2001	December 2001/ November 2002	48.00
Panniar: 2 units	September 2001	November 2001/ February 2003	30.00

3.21. Audit analysis disclosed that there was failure on the part of the Board in getting technology transfer and training of personnel as envisaged in the contract with SNC. The equipment supplied by the SNC also had various defects and certain equipment received could not be utilised. The delay in execution of the project also entailed consequential losses. Instances of extra expenditure or loss arising from the above deficiencies are discussed in the succeeding paragraphs.

Transfer of technology and training of Board's Engineers

3.22. The contracts for consultancy services provided for transfer of technology and technical training of Board's engineers. An amount of 1.48 lakh CAD (Rs. 37 lakh) was included for this purpose in the total agreed ceiling of 7.19 million CAD (Rs 17.89 crore). The services were to be provided by SNC at their offices as well as utilities in Canada, construction

sites, etc., as specified in the contracts. Since the state of the art technology equipment were supplied and erected by SNC, training of the Board's engineers was essential to ensure the quality and reliability of Canadian equipment at the design stage itself and for further operation and maintenance. The Board, however, failed to avail of the benefits of training of Board's engineers and technology transfer in terms of the contract.

In the absence of technology transfer and training programmes, and non-disclosure of technical specifications in Annexure I-D to the agreement, the Board's engineers were not adequately equipped to assess the suitability and reliability of the imported machinery either at the time of procurement or at the time of erection. As a result the Board could not identify and rectify defects in machinery, installed by SNC resulting in losses, as discussed in paragraphs *3.24 to 3.26 infra*.

3.23. The reduction to be made in consultancy charges on account of the non-availment of the above services was 1.48 lakh CAD (Rs 37 lakh) and ceiling for consultancy charges correspondingly came down to 7.04 million CAD. Ignoring this the Board released (March 2005) pending payments to SNC reckoning the overall ceiling as 7.19 million CAD. The avoidable payment so made amounted to Rs.37 lakh (1.48 lakh CAD).

The Government stated (August 2005) that technical training programme and technology transfer was achieved to a large extent in India itself and that there was no substantial loss to the Board. The reply is not acceptable in view of the fact that the training to be imparted at the manufacturer's works at Canada during the design stage and on an operational plant could not be imparted in India. Accordingly, the benefit of the training of the Board's engineers did not accrue to the Board.

Supply of Draft-Tube Gate (DTG)

3.24. The contract with SNC was for renovation of the existing facilities at Panniar. The site inspection and identification of equipment to be replaced was, however, not undertaken with proper care. Due to this the list of equipment to be renovated by SNC as per contract included two Draft Tube Gates intended for shutting down the flow of tail race water from one generator to draft tubes of the other generator even though no such gates were actually available at the Panniar Power Station. The cost of repair of these gates as included in the value of contract was 19,000 CAD. Subsequently SNC designed and supplied (November 2000) a new draft tube gate, the measurement of which did not suit the existing draft tube outlet. These defects were also not inspected and identified by the Board's engineers in the absence of sufficient knowledge or expertise in the technology transferred by SNC. The expenditure of Rs.5.99 lakh (19,000 CAD) incurred on the DTG was a loss to the Board.

Absence of pre-contract identification of items to be renovated and failure to inspect off-specification goods resulted in avoidable loss of Rs.1.78 crore.

3.25. For erection of DTG and Electrical hoist with gantry cranes, the Panniar Power Station was shut down from 10 April 2002 to 19 June 2002. The defects in the DTG were noticed only during erection and finally the installation was rendered abortive. The avoidable loss of generation due to spillage of water during the shut down period required for rectification of the

above defects worked out to 5.731 MU valued at Rs.1.78 crore at the rate of Rs.3.10 per unit.

Supply of Generator Metering Equipment.

3.26. The renovation contract included supply and installation of new computer based central control and supervision system with Nexus metering equipment. Even though the metering installation by the sub-contractor (Alstom) of SNC in other countries were having problems due to design defect of Nexus equipment, SNC suppressed this information from the Board. The central control and supervision system for all the three Power Stations were supplied (September 2000 to January 2001) by SNC at a total landed cost of Rs.1.92 crore. On installation and commissioning of the control equipment, the Generator metering equipment was not functioning properly. Several attempts made by SNC could not rectify the defects (May 2004). Since the equipment with design defects were supplied by SNC suppressing material information, the Board's engineers also could not identify this prior to installation.

The supply of equipment with design defects and failure to recover the cost from SNC resulted in loss of Rs.1.92 crore.

Government stated (August 2005) that the equipment manufacturer after testing in the laboratories, observed that the instruments were not functioning correctly and the defects have since been rectified. It was also stated that even if Nexus meters were not functioning the performance of the generators would not be affected. The reply is not acceptable in view of the fact that the SNC themselves had identified (25.07.2002) that 'Nexus being used by Alstom was a defective design, as it was reported that the problem was surfacing on other installations (in other countries) as well'. The failure of this equipment resulted in very serious problems leading to shut down of generating units as reported by the Board's engineers.

Thus, the supply of equipment with design defect by the contractor and failure of the Board to recover the cost form SNC resulted in a loss of Rs.1.92 crore.

Cost of projects

3.27. As per the norms fixed by the Central Board of Irrigation and Power (CBIP), the cost of capacity benefit in the case of renovation and modernisation of units of hydro Power Stations should be 25 to 30 *per cent* as compared to the cost of installing a new generating unit.

The total cost of the Kuttiady Additional Extension Scheme, a new hydro electric project with an installed capacity of 100 Mega Watt (MW) awarded to M/s BHEL/L&T on a turn key basis (August 2003) was Rs.66.05 crore; the per megawatt cost being Rs.0.66 crore. Based on the norms of CBIP, the per MW cost of the Pallivasal, Sengulam and Panniar, Renovation project should not have exceeded Rs.0.50 crore (75 *per cent* of 0.66 crore) per MW. The total cost ceiling for the three projects worked out to Rs 57.75 crore (115.5 MW @ Rs.0.50 crore per MW). Based on the aggregate cost of Rs 374.50 crore booked by the Board for the renovation of the three projects as of December 2004, the per MW cost worked out to Rs 3.24 crore indicating a total excess cost of Rs 316.75 crore with reference to norms.

The cost of the projects were excessive by Rs 316.75 crore with reference to CBIP norms.

3.28. It was further noticed in audit that the per MW cost of renovation, modernisation and life extension projects undertaken by various Electricity Boards in the country during the period from 1992 to 2003 ranged between Rs.0.11 crore and Rs.2.34 crore only as detailed in **Annexure 18**. Even with reference to the highest cost of Rs.2.34 crore per MW in respect of Umium Stage I Project (Meghalaya) completed during the year 2003, the additional cost incurred on the renovation and modernisation of the three projects in Kerala worked out to Rs.103.95 crore.

Government stated (August 2005) that the per MW cost of Kuttiyadi Additional Extension Scheme and the renovation projects could not be strictly compared due to difference in the scope of works and source of machinery and equipments. The reply is not acceptable since the per MW cost of the three projects involving only renovation and modernisation was very much higher than the per MW cost of new Kuttiyadi Additional Extension Scheme, implemented by the Board. The cost of the renovation project has to be a maximum of 75 *per cent* of the cost of a new project as per CBIP norms and it can not be as high as 648 *per cent* as in the instant case.

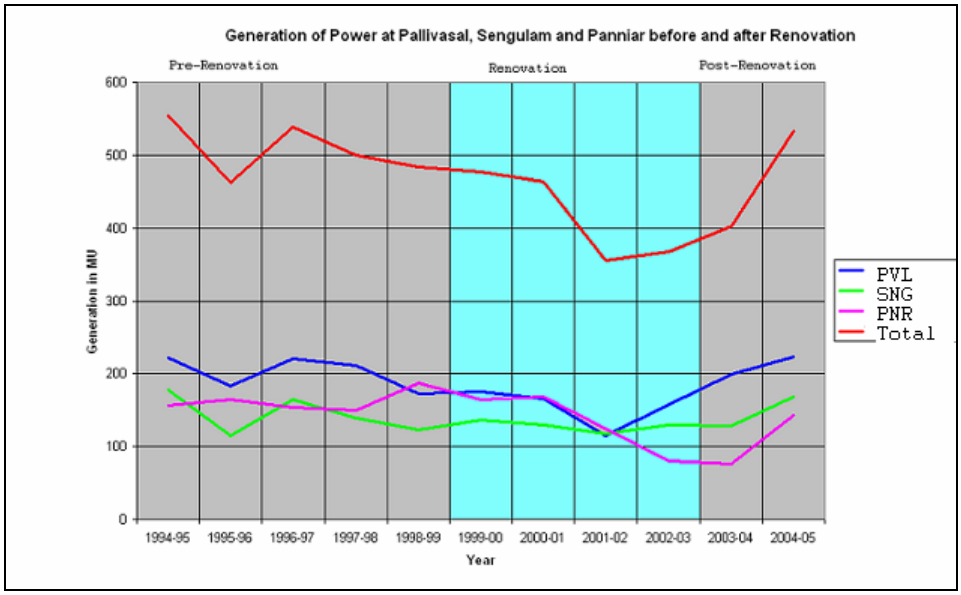
Performance

Generation of Power

3.29. The projects were renovated and re-commissioned during the period October 2000 to February 2003. The table below indicates the year-wise details of generation of power in each of the three Power Stations at Pallivasal, Sengulam and Panniar, and the rainfall obtained at the respective project areas during the pre-renovation (1994-95 to 1998-99) renovation (1999-2000 to 2002-03) and post renovation periods (2003-04 to 2004-05) of the project:

Year	Rainfall at Pallivasal (Kundala & Madupetty) (mm)	Generation at Pallivasal (MU)	Generation at Sengulam (MU)	Rainfall at Panniar (Anayirankal & Ponmudi) (mm)	Generation at Panniar (MU)	Total rainfall in Project areas (mm)	Total Generation (MU)
1	2	3	4	5	6	7	8
Pre-renovation period							
1994-95	1733.00	221.96	177.15	2544.00	156.06	4277.00	555.17
1995-96	1293.00	183.74	114.63	2285.00	164.18	3578.00	462.55
1996-97	1513.00	220.69	164.70	1986.00	153.54	3499.00	538.93
1997-98	NA	211.63	139.30	2194.00	149.33	NA	500.26
1998-99	1251.00	172.85	123.45	2336.00	187.70	3587.00	484.00
Renovation period							
1999-00	3986.00	175.60	136.66	2138.00	164.60	6124.00	476.86
2000-01	3243.50	165.35	129.70	2178.00	187.60	5421.50	482.65
2001-02	2841.10	118.00	117.00	2636.00	123.90	5477.10	358.90
2002-03	2015.99	157.00	129.66	1629.00	79.71	3644.99	366.37
Post-renovation period							
2003-04	2085.00	192.99	128.07	1984.00	75.61	4069.00	396.67
2004-05	2874.50	222.89	168.09	2733.00	142.52	5607.50	533.56

3.30. A graph showing the project-wise generation and total generation of power during the pre-renovation, renovation and post-renovation period is given below:



3.31. It would be seen from the above details that during the five year period of 1994-95 to 1998-99 (prior to renovation), the total rainfall at the concerned project areas ranged between 3499 mm and 4277 mm and the total power generated by the three Power Stations ranged between 462.55 and 555.17 MU. When compared to this the rainfall during the post renovation period ranged between 4069 mm and 5607 mm and the generation was between 396.67 to 533.56 MU only, indicating that the Board's main objective of improvement in efficiency could not be achieved.

Government stated (August 2005) that the reduction in power generation during 2000-2003 was due to the fact that half the machines of the three stations were under shut down for renovation and the reduction during 2003-04 was mainly due to very low rainfall compared to other years. The reply is not acceptable since 50 *per cent* of all the machines were not shut down during the entire three-year period of renovation. Further, the rainfall in the project area was adequate to generate more power than during the earlier years as indicated in the table.

A few cases of the serious machine problems contributing to the lower efficiency levels of generation are discussed below:

Pitting in the turbine runner buckets

3.32. Turbine runner bucket formed an integral part of the turbine. There were such buckets attached to the system installed at the Pallivasal Power Station. In the technical specification furnished by SNC adequate protection had to be provided to all surfaces of turbine parts which came into contact with water and against erosion due to silty water. Runner buckets were to be given particular consideration.

It was however, noticed in audit that during November 2002, barely 3 months after commissioning, the renovated Units IV, V and VI of Pallivasal Power Station developed cavitations due to erosion of material (pitting) in the buckets of the turbine runners. Unit V was shut down on 30 October 2002 to replace the runner with the spare runner supplied by the contractor and the machine restarted on 3 December 2002. The manufacturer of the runners viz. Alstom who were also the sub-contractors of SNC for the work, arranged for modification of the runners of Units IV, V and VI, and these were put back in service in May/June 2003.

It would be pertinent to mention that the turbines of the old machines at this Power Station had not experienced any problem of pitting during its operation for more than 50 years.

3.33. The rated speed of the turbines supplied by SNC for Units IV to VI of Pallivasal Power Station was 750 revolutions per minute (rpm) instead of 600 rpm provided in the contract. The change in rpm of the turbines made arbitrarily by SNC violating the contract conditions was not investigated by the Board even though this change was identified (August 2004) as a reason for pitting. In terms of the contract, the supplier was bound to replace/repair the defective equipment supplied. The Board, however, did not initiate any action to obtain replacement of the runners (cost-Rs.2.78 crore) by the suppliers within the warranty period, which was in operation up to July 2004. The Board continued to repair and use the runner buckets.

3.34. Consequent on the pitting the new turbines of units IV, V and VI of Pallivasal were estimated to require at least two repairs every year and the estimated cost of repair of 3 runners during the useful life of 45 years was Rs.1.35 crore (3x2x45 at the rate of Rs.50,000) at the then existing rates. In the absence of specific provisions in the contract, the Board would not be in a position to recover the amount spent on repairs as well as consequential generation loss during repair shutdown.

Government stated (August 2005) that the manufacturer was not able to give a ready made solution to the pitting problem and that for associated expenditure for additional weld repair for 10 years an amount of CAD 60,000 had been recommended by the Board of Members of KSEB to be back charged to SNC. The reply is not tenable in view of the fact that there did not exist any provision in the contract to effect recovery in such case.

Defective governors [*]

Failure of the Board to replace defective governors or recover the cost from suppliers resulted in unproductive expenditure of Rs.10.08 crore.

3.35. Ever since installation of the new 'Digital PID Governors' at the Pallivasal, Sengulam and Panniar Power Stations, the speed response of the governors were defective resulting in tripping of generators leading to power interruption as well as generation loss. All the above problems were reported (November 2004) to be due to inadequacy in the operation of the governors supplied by SNC at a cost of Rs.10.08 crore (3.25 million CAD). SNC is reported to have admitted that the governors were beyond repairs. The Board,

[*] Equipment intended to keep the speed of turbines constant under changes in load and other disturbances.

however, did not initiate any action either to get replacement for the governors or to recover the cost from SNC.

The Government stated (August 2005) that an amount of 39,000 CAD was proposed to be back-charged to SNC to compensate for the generation loss due to unwanted tripping. The reply is not acceptable in view of the fact that there was neither any provision in the contract for such recovery nor was there any balance due to SNC to adjust the amount.

Thus, the failure to replace or recover the cost of defective governors supplied by the contractor resulted in unproductive expenditure of Rs.10.08 crore.

Necessity for renovation

3.36. The renovation work of Pallivasal, Sengulam and Panniar Power Stations was undertaken by the Board with the objective of improving efficiency of the machine and reduce the generation loss due to forced shut downs. While taking the decision for renovation, the recommendations (1992) of the CEA that replacement of the machines at Pallivasal Power Station was not necessary in view of the good condition of the plant and the necessity for renovation in the context of proposed Pallivasal Extension Scheme of 60 MW capacity, were not given due consideration. Since the Power Station at Sengulam was of the same type (Pelton) as at Pallivasal and that at Panniar was relatively new (1964) the renovation involving huge cost was not immediately necessary.

Due to various technical defects in the equipment renovated and non-achievement of pre-renovation generation levels the expenditure of Rs.374.50 crore did not yield commensurate gains.

The Board also could not ensure quality of the renovation work carried out by SNC, in the absence of technology transfer and training of its engineers by the Contractor. Due to various technical defects in the equipment installed by SNC, the generation of power could not be maintained even at the pre-renovation levels and the Board had to incur avoidable expenditure on repairs and loss of generation due to shutdowns.

Thus, the expenditure on renovation amounting to Rs.374.50 crore did not yield commensurate gains.

Conclusion

The Board resorted to the renovation and modernisation of Pallivasal, Sengulam and Panniar hydro electric projects ignoring the recommendation of the CEA regarding the good condition of the plant at Pallivasal. Neither the prior concurrence of CEA for incurring capital expenditure for the projects was obtained nor did the Board conduct any feasibility study before signing the Memorandum of Understanding for the projects. The Consultancy contracts were finalised without obtaining prior formal approval of the Board of Members. The final contract for supply of equipment and engineering services was finalised by a Ministerial delegation directly with the consultant who was acting as an intermediary and was not the manufacturer. The supply of goods and services were actually made by other firms at much higher cost leading to extra avoidable payments. The Board also could not ensure quality of renovation work executed by the Contractor in the absence of technology

transfer and training of its engineers by the Contractor. Due to various technical defects in the equipments, the generation of power could not be maintained even at pre-renovation levels; the Board had to incur avoidable expenditure on repairs. The very objective of improvement in the efficiency of machines could not be achieved as there was no improvement in the generation of power.

Recommendations

- ***The State Government and the Board may put in place a proper system for project formulation and Management. Efforts should be made to derive the benefit of accepted best practices and procedures in the identification of consultants and vendors for execution of projects with a view to protect the financial interests of the Board.***
- ***The Board should finalise tenders for supply and installation directly with the manufacturers rather than through intermediaries and should take adequate care to ensure quality as well as performance of plants procured.***
- ***Prior to finalisation of project contracts, the Board should compare the cost of similar foreign/indigenous projects finalised/executed to secure cost effectiveness and value for money. Adequate care should also be taken in reducing financing costs while negotiating finance from foreign sources.***
- ***Effective follow-up action is necessary to ensure that foreign grants linked to projects as cost effective components are ultimately received and gainfully utilised.***